Important Basics of Parallel & Single Reactions Formulas PDF

Formulas
Examples
with Units

List of 16
Important Basics of Parallel & Single Reactions Formulas

1) Instantaneous Fractional Yield Formula

Evaluate Formula

Formula

$$\varphi = \frac{dP}{dR}$$

Example with Units

$$0.6 = \frac{27\,\text{mol}}{45\,\text{mol}}$$

2) Molar Feed Rate of Reactant using Reactant Conversion Formula

Evaluate Formula

Formula

$$F_{Ao} = \frac{F_A}{1 - X_A}$$

Example with Units

$$5\,\text{mol/s} = \frac{1.5\,\text{mol/s}}{1 - 0.7}$$

3) Molar Flow Rate of Unreacted Reactant using Reactant Conversion Formula

Evaluate Formula

Formula

$$F_A = F_{Ao} \cdot \left(1 - X_A\right)$$

Example with Units

$$1.5\,\text{mol/s} = 5\,\text{mol/s} \cdot \left(1 - 0.7\right)$$

4) Number of Moles of Product Formed Formula

Evaluate Formula

Formula

$$dP = dR \cdot \varphi$$

Example with Units

$$27\,\text{mol} = 45\,\text{mol} \cdot 0.6$$

5) Number of Moles of Reactant Reacted Formula

Evaluate Formula

Formula

$$dR = \frac{dP}{\varphi}$$

Example with Units

$$45\,\text{mol} = \frac{27\,\text{mol}}{0.6}$$

6) Overall Fractional Yield Formula

Evaluate Formula

Formula

$$\Phi = \frac{P}{R_0 - R_f}$$

Example with Units

$$0.6 = \frac{5.835\,\text{mol}}{15\,\text{mol} - 5.275\,\text{mol}}$$

7) Reactor Space Time Formula

Evaluate Formula

Formula

$$\tau_{Reactor} = \frac{V_{reactor}}{v_o}$$

Example with Units

$$0.2541\,s = \frac{2.49\,m^3}{9.8\,m^3/s}$$

8) Reactor Space Velocity Formula

Evaluate Formula

Formula

$$s_{Reactor} = \frac{v_o}{V_{reactor}}$$

Example with Units

$$3.9357\,cycle/s = \frac{9.8\,m^3/s}{2.49\,m^3}$$

9) Space Time using Molar Feed Rate of Reactant Formula

Evaluate Formula

Formula

$$\tau = \frac{C_{A0} \cdot V_{reactor}}{F_{Ao}}$$

Example with Units

$$14.94\,s = \frac{30\,mol/m^3 \cdot 2.49\,m^3}{5\,mol/s}$$

10) Space Time using Space Velocity Formula

Evaluate Formula

Formula

$$\tau_{Spacevelocity} = \frac{1}{s}$$

Example with Units

$$16.6667\,s = \frac{1}{0.06\,cycle/s}$$

11) Space Velocity using Molar Feed Rate of Reactant Formula

Evaluate Formula

Formula

$$s = \frac{F_{Ao}}{C_{A0} \cdot V_{reactor}}$$

Example with Units

$$0.0669\,cycle/s = \frac{5\,mol/s}{30\,mol/m^3 \cdot 2.49\,m^3}$$

12) Space Velocity using Space Time Formula

Evaluate Formula

Formula

$$s = \frac{1}{\tau}$$

Example with Units

$$0.0669\,cycle/s = \frac{1}{14.94\,s}$$

13) Total Product Formed Formula

Evaluate Formula

Formula

$$P = \Phi \cdot \left(R_0 - R_f \right)$$

Example with Units

$$4.8625\,mol = 0.5 \cdot \left(15\,mol - 5.275\,mol \right)$$

14) Total Reactant Fed Formula

Evaluate Formula

Formula

$$R_0 = \left(\frac{P}{\Phi} \right) + R_f$$

Example with Units

$$16.945\,mol = \left(\frac{5.835\,mol}{0.5} \right) + 5.275\,mol$$

15) Total Reactant Reacted Formula

Evaluate Formula

Formula

$$R = R_0 - R_f$$

Example with Units

$$9.725\,\text{mol} = 15\,\text{mol} - 5.275\,\text{mol}$$

16) Total Unreacted Reactant Formula

Evaluate Formula

Formula

$$R_f = R_0 - \left(\frac{P}{\varphi}\right)$$

Example with Units

$$5.275\,\text{mol} = 15\,\text{mol} - \left(\frac{5.835\,\text{mol}}{0.6}\right)$$

Variables used in list of Basics of Parallel & Single Reactions Formulas above

- C_{A0} Concentration of Reactant in Feed *(Mole per Cubic Meter)*
- **dP** Number of Moles of Product Formed *(Mole)*
- **dR** Number of Moles of Reactant Reacted *(Mole)*
- F_A Molar Flow Rate of Unreacted Reactant *(Mole per Second)*
- F_{Ao} Molar Feed Rate of Reactant *(Mole per Second)*
- **P** Total Moles of Product Formed *(Mole)*
- **R** Total Reactant Reacted *(Mole)*
- R_0 Initial Total Moles of Reactant *(Mole)*
- R_f Total Moles of Unreacted Reactant *(Mole)*
- **s** Space Velocity *(Cycle per Second)*
- $s_{Reactor}$ Reactor Space Velocity *(Cycle per Second)*
- v_o Volumetric Flow Rate of Feed to Reactor *(Cubic Meter per Second)*
- $V_{reactor}$ Reactor Volume *(Cubic Meter)*
- X_A Reactant Conversion
- φ Instantaneous Fractional Yield
- Φ Overall Fractional Yield
- τ Space Time *(Second)*
- $\tau_{Reactor}$ Reactor Space Time *(Second)*
- $\tau_{Spacevelocity}$ Space Time using Space Velocity *(Second)*

Constants, Functions, Measurements used in list of Basics of Parallel & Single Reactions Formulas above

- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Amount of Substance** in Mole (mol)
  Amount of Substance Unit Conversion
- Measurement: **Volume** in Cubic Meter (m^3)
  Volume Unit Conversion
- Measurement: **Frequency** in Cycle per Second (cycle/s)
  Frequency Unit Conversion
- Measurement: **Volumetric Flow Rate** in Cubic Meter per Second (m^3/s)
  Volumetric Flow Rate Unit Conversion
- Measurement: **Molar Flow Rate** in Mole per Second (mol/s)
  Molar Flow Rate Unit Conversion
- Measurement: **Molar Concentration** in Mole per Cubic Meter (mol/m^3)
  Molar Concentration Unit Conversion

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